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Colour and logarithmic accuracy in final-state parton showers

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Standard dipole parton showers are known to yield incorrect subleading-colour contributions to the leading (double) logarithmic terms for a variety of observables. In this work, concentrating on final-state showers, we present two simple, computationally efficient prescriptions to correct this problem, exploiting a Lund-diagram type classification of emission regions. We study the resulting effective multiple-emission matrix elements generated by the shower, and discuss their impact on subleading colour contributions to leading and next-to-leading logarithms (NLL) for a range of observables. In particular we show that the new schemes give the correct full colour NLL terms for global observables and multiplicities. Subleading colour issues remain at NLL (single logarithms) for non-global observables, though one of our two schemes reproduces the correct full-colour matrix-element for any number of energy-ordered commensurate-angle pairs of emissions. While we carry out our tests within the PanScales shower framework, the schemes are sufficiently simple that it should be straightforward to implement them also in other shower frameworks.

Author: MEDVES, Rok (University of Oxford)

Co-authors: SALAM, Gavin (University of Oxford); SOYEZ, Gregory (IPhT, CEA Saclay); HAMILTON, Keith (University College London (GB)); SCYBOZ, Ludovic (University of Oxford)

Presenter: MEDVES, Rok (University of Oxford)

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